

# Ideas of Final Projects

Read the “Final Project Instructions” first before shopping for final project topics.

**Do NOT limit yourself to the topics listed below.** All topics related to scientific computing are welcome. Choose some topic that you are truly interested in and may help your resume sparkle.

## 1 Financial Modeling and Simulation

Financial modeling involves creating mathematical representations of financial scenarios, aiding in decision-making. Students can simulate stock prices, portfolio performance, and risk analysis to analyze various investment strategies and market conditions. Students may need the knowledge of linear algebra, probability, and statistics.

## 2 Epidemiological Modeling

Epidemiological modeling is a field of study that utilizes mathematical and computational techniques to understand the spread and dynamics of infectious diseases within populations. These models aim to capture the complex interactions between individuals, pathogens, and the environment, allowing researchers to simulate various disease scenarios and predict outcomes. Students can explore epidemiological models (such as SIR models), forecast disease trends, and investigate critical points of the dynamics.

## 3 Car-following Models for Traffic Flow

Car-following models for traffic flow are essential tools in transportation engineering, employing mathematical and computational techniques to simulate how vehicles interact on roadways. These models predict traffic patterns, congestion dynamics, and the impacts of different control strategies. Students can analyze how factors like acceleration, deceleration, and inter-vehicle spacing affect traffic flow and ultimately improve the efficiency and safety of transportation systems.

## 4 Image Compression and Segmentation

Image compression aims to reduce the size of an image file while preserving its essential visual information. Image segmentation involves partitioning an image into multiple meaningful regions

or segments based on certain characteristics such as color, texture, intensity, or spatial proximity. Students can explore techniques in this field and work on real applications.

## **5 Opinion Dynamics on Social Networks**

Opinion dynamics models are computational frameworks used to study how opinions evolve and spread within a population over time. These models simulate interactions between individuals, considering factors like social influence, network topology, and individual decision-making processes. Students can incorporate mathematical equations to simulate agent-based opinion dynamics and replicate complex dynamics such as opinion polarization, consensus formation, and the emergence of echo chambers.